SOIL SURVEY OF THE YAZOO AREA, MISSISSIPPI.

By JAY A. BONSTEEL and PARTY

LOCATION AND BOUNDARIES OF THE AREA.

The area surveyed comprises a strip 18 miles broad extending from the Choctaw meridian on the east to the western boundary of Yazoo County. From this line a strip 9 miles broad, lying in Township 12

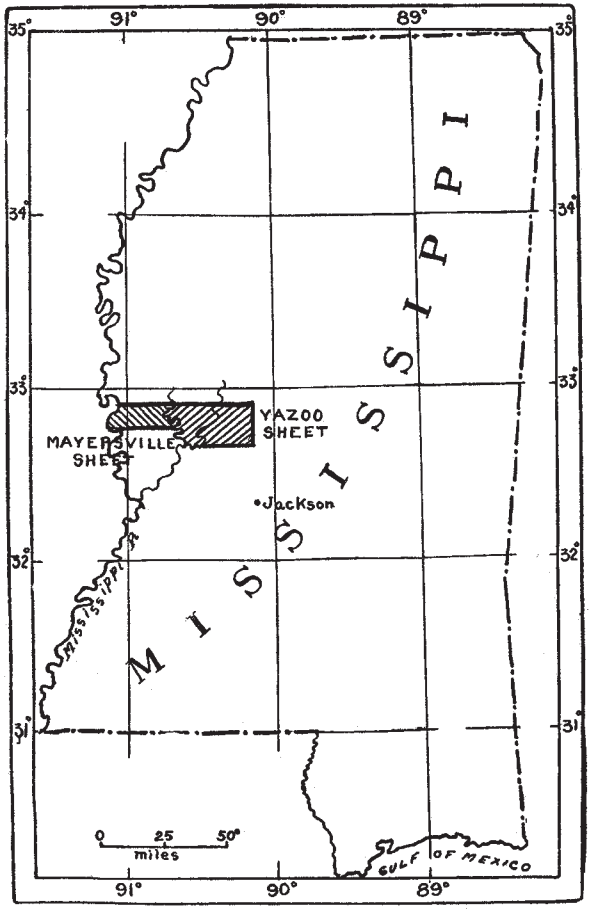


FIG. 11.—Sketch map showing areas surveyed in Mississippi.

and the northern half of Township 11, was surveyed across Sharkey and Issaquena counties from Range 5 to the Mississippi River. (See fig. 11.) Of the Yazoo County portion of the area a little less than one-

half lies in the upland portion of the State, while the remainder of the area in Yazoo, Sharkey, and Issaquena counties lies in that portion of the Mississippi River flood plain known as the Yazoo Delta. The upland and delta portions of the area are sharply separated by a pronounced bluff which extends obliquely across the central portion of Yazoo County, with a northeast and southwest trend.

The Yazoo River follows a winding course near the bluff line. The Sunflower River flows through the northern portion of the Sharkey County area and forms the boundary between Yazoo and Sharkey counties in the southern portion. The Little Sunflower River and Little Deer Creek flow through Sharkey County, while Steels Bayou forms a winding channel, formerly navigated, in Issaquena County. The Mississippi River forms the western boundary of Issaquena County. Many small lakes and bayous exist in the delta portion of the area.

The hill portion of the area surveyed is drained by an intricate system of small creeks. Most of these flow into the Yazoo River, though the drainage of the eastern and southeastern portions of the area flows into Big Black River.

The principal towns of the Yazoo County area are located along the bluff line. Of these the county seat, Yazoo City, is the largest. It has a population of about 6,000, and its location upon the Yazoo River, together with its railroad facilities, have caused it to become one of the chief commercial centers of this part of the State.

HISTORY.

The first European knowledge of the territory comprised within the present limits of the State of Mississippi was obtained by De Soto and his followers. Their journey led them across the northeastern part of the State in 1540, and they went into winter quarters probably in Pontotoc County, crossing the Mississippi River in 1541.

La Salle, accompanied by Chevalier Tonti, descended the Mississippi River in 1682 and took possession of the country for France. D'Iberville made the first settlement in the State at Biloxi, near the present town of Ocean Springs, in 1699. Natchez was founded by the construction of Fort Rosalie in 1700.

It was not until June, 1718, that the first settlement in the Yazoo River country was made. Large grants of land had been given to a company consisting of Le Blanc, Count de Belleville, Leblond, and others, and this company sent De la Housaye and Scouvion, with 82 followers, who settled on the Yazoo. Of the emigrants of 1720, 390 were destined for the Yazoo settlement. In 1719 Bigart erected Fort St. Peter, 9 miles above the mouth of the Yazoo River, and now known as Haynes Bluff. Here an area of about 30 acres was cultivated.

After the failure of the Crown company which controlled this pioneer settlement, many of the Frenchmen of the settlement married Indian wives and were adopted by their respective tribes. Nevertheless, until 1730 the various settlements prospered and considerable agricultural activity was manifested.

Indian troubles followed, and in 1730 the French settlement on the Yazoo was entirely destroyed by the Natchez Indians. Although the Natchez tribe was itself nearly exterminated by later wars against the French and their allies, the Choctaws, the colonization of this portion of the State was not renewed until the English occupancy, which began in 1763. The region remained under control of England until 1779, when it was conquered by a force under Gálvez, the Spanish governor of Louisiana. The region took no part in the Revolutionary struggle against England, aside from furnishing a refuge to emigrants of both parties from the disturbed States along the Atlantic coast. Among the accessions to the population about this time were numbers of settlers from the Carolinas, Virginia, New Jersey, and even New England.

The territory as far south as 31° north latitude passed under the dominion of the United States on the conclusion of peace with Great Britain in 1783. The exact boundaries remained a question of dispute with Spain. The United States claimed the parallel of 31° as its southern boundary, according to treaty with England, while Spain claimed a line drawn east from the mouth of the Yazoo River as the northern boundary of her colony, also according to the former limits of the English province of West Florida, which had been ceded to Spain. This question was finally settled in favor of the United States.

During the early colonial days, especially under French rule, agriculture was largely subordinated to the fur trade, but with English occupation the first systematic and successful agriculture was developed. Tobacco was early a product of importance. It was inspected by Spanish officials, and through them sold to the royal monopoly. Rice and sugar, flaxseed, indigo, corn, buckwheat, barley, peas, oats, rye, wheat, and potatoes were produced.

Cotton cultivation dates from the earliest English occupation, and it supplanted tobacco and indigo as a staple crop. It was cultivated almost exclusively in the upland country by German redemptioners and by African slaves. Rice was still raised in the southwestern counties.

There was a great lack of iron for the manufacture of agricultural implements and milling machinery, even up to the time when Mississippi became a State. Nevertheless, makeshifts suggested by ingenuity and required from necessity were employed in the place of better fashioned tools.

Supplies from the States were laboriously brought by flatboats and keel boats down the Ohio and Mississippi rivers, while a large part of the shipments were made by coasting vessels from New Orleans.

The earliest settlements of any magnitude within the area covered by the present survey were made in the upland region, while in the delta the first plantations were of necessity located along navigable streams.

Yazoo and Issaquena counties produced considerable amounts of cotton by 1840, and the census returns of that period also enumerate butter, cheese, sweet potatoes, Irish potatoes, corn, rye, oats, barley, and peas among the products.

The areas devoted to cotton have steadily increased, while the yield per acre has steadily but slowly decreased. The yield per acre of cotton in the delta country has always exceeded that of the upland, and cotton is more the great single staple of the delta than of any other portion of the State.

CLIMATE.

Of the five stations included in the following tables only Yazoo City lies within the area of the survey. Greenville is the nearest delta station; Agricultural College is a hill station of about the same latitude as Greenville; while Vicksburg and Crystal Springs may be taken as fairly representative of the climatic conditions of the principal trucking region of Mississippi.

The tables of precipitation show a sufficient rainfall at all of the stations to insure a good supply of moisture during the period of crop growth. They also show a minimum of monthly rainfall during the important cotton-picking season—September, October and November.

The tables of temperature also show a very uniform change of temperature, with neither excessive cold in winter nor excessive heat in summer. The delta station, Greenville, shows a more even range in temperature and a lower annual mean than any of the others. It approaches closely to the record of Crystal Springs, in the trucking region, and this fact, taken in conjunction with the favorable soil conditions existing in the delta, indicate the possibility of the introduction of the trucking industry into that region.

The table showing the dates of latest and earliest frosts also indicates a favorable climate in the delta. The figures are from Weather Bureau records.

Normal monthly and annual temperature and precipitation.

Month.	Agricultural College.		Greenville.		Vicksburg.		Yazoo City.		Crystal Springs.	
	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	In.	°F.	In.	°F.	In.	°F.	In.	°F.	In.
January	.....	.....	45.7	5.38	47.6	5.76	46.4	6.06	47.7	6.52
February	.....	.....	48.1	4.36	52.2	4.70	45.4	4.43	48.9	5.19
March	.....	.....	52.4	5.84	58.2	6.14	60.0	5.69	59.2	3.97
April	64.8	3.21	66.5	4.14	66.0	5.86	66.8	4.48	66.8	3.69
May	71.8	3.26	72.9	3.45	72.6	4.94	76.3	3.02	74.1	3.65
June	78.2	3.39	78.9	3.72	80.0	4.67	81.4	3.96	79.8	4.73
July	80.9	5.32	81.4	4.33	81.2	4.47	83.4	4.92	81.4	6.74
August	79.9	4.47	80.6	3.80	81.2	3.32	83.5	4.71	80.8	4.42
September	73.5	2.74	74.6	2.86	76.0	3.37	76.9	2.42	75.9	2.53
October	64.6	1.62	63.1	1.95	66.4	2.69	64.5	1.80	66.8	2.08
November	54.0	2.86	53.5	3.74	56.2	4.48	55.5	3.10	56.1	3.19
December	48.2	4.17	47.7	3.77	50.6	4.96	47.7	4.09	48.8	5.64
Annual	.....	.....	63.8	47.12	65.7	54.42	65.6	48.68	65.5	53.11

Dates of killing frosts.

Year.	Agricultural College.		Greenville.		Vicksburg.		Yazoo City.		Crystal Springs.	
	Last in spring.	First in fall.	Last in spring.	First in fall.	Last in spring.	First in fall.	Last in spring.	First in fall.	Last in spring.	First in fall.
1892	Mar. 20	Nov. 11	Mar. 19	Nov. 11	Mar. 2	Nov. 11	.....	.....	.....	Nov. 10
1893	Mar. 6	Oct. 29	Mar. 5	Oct. 16	Apr. 22	Nov. 15	.....	Oct. 30	Mar. 30	Oct. 15
1894	Mar. 29	Nov. 9	Mar. 30	Oct. 31	Mar. 29	Nov. 11	Mar. 30	Nov. 6	Mar. 30	Oct. 9
1895	Mar. 21	Nov. 2	Mar. 21	Oct. 10	Mar. 17	Nov. 11	Mar. 21	Nov. 2	Mar. 21	Oct. 21
1896	Apr. 3	Dec. 3	Mar. 20	Oct. 18	Mar. 20	Nov. 9	Mar. 21	Nov. 8	Apr. 3	Nov. 6
1897	Feb. 27	Nov. 17	Feb. 27	Nov. 17	Feb. 27	Nov. 17	Feb. 27	Nov. 10	Feb. 27	Nov. 17
1899	Mar. 29	Nov. 3	Mar. 29	Nov. 3	Mar. 7	Nov. 3	Mar. 29	Nov. 3	Mar. 29	Nov. 3
1900	Apr. 5	Nov. 9	Mar. 17	Nov. 9	.....	.....	Mar. 31	Nov. 10	Apr. 1	Nov. 4

The climate of the region is that of the warm temperate regions of the United States, and for this reason a wider range of crop diversification is possible than in either warmer or colder localities. When the variation in soil condition is also considered, it would seem that all the chief agricultural necessities of any community could be raised in the area under consideration. The delta region is also favored by the possibility of securing an abundant supply of good artesian water at a depth varying from 700 to 1,200 feet.

GEOLOGY AND PHYSIOGRAPHY.

Yazoo County lies within that physiographic subdivision of the United States known as the Gulf Coastal Plain; that is, the materials which constitute not only Yazoo County, but also the greater part of the State of Mississippi, are sediments, such as gravel, sand, silt, and clay, which at one time formed the floor of a northward extension of

the Gulf of Mexico. Relative changes of level between the surface of the land and the surface of the water long ago laid bare this old sea floor. While this change was taking place streams flowing from the areas of land already existing to the northward gradually established a southward extension of their valleys across this new-formed land. The greatest of these streams was the Mississippi River, and it has surpassed in its work the work of all other streams in the region, controlling their courses and influencing not only the physical features of the landscape, but also the relationships of the geological formations, the climatic conditions of the region, the formation and distribution of soils, the agricultural possibilities of the State, and even the character of the population.

Physically, the area covered by the present survey lies in two divisions. The eastern division comprises a hill section extending eastward from the bluff at Yazoo City and Satartia. The western division comprises a portion of the Mississippi flood plain known as the Yazoo Delta, extending westward to the Mississippi River. The delta portion of the area is a low, flat, alluvial bottom, having an average altitude above the Gulf of about 100 feet. The maximum differences of elevation within this flood plain range within an extreme of 20 feet. The drainage systems consist of an intricate maze of winding stream channels, crooked bayous, and narrow lakes. The streams branch and reunite. The bayous and lakes curve in broad arcs and bend back upon themselves, inclosing large and small peninsulas and islands. They constitute a water system peculiar to the new-formed areas of the great flood plains of the world. The flood plain in the Yazoo area is separated from the hill country to the east by a sharp escarpment or bluff, which extends from Memphis southward to Baton Rouge in a long, flat arc, and forms the boundaries of the Mississippi delta. It has an average altitude of about 250 feet above the flood plain. The front line of this escarpment is broken at frequent intervals by deep V-shaped valleys, through which short tributary streams flow down to

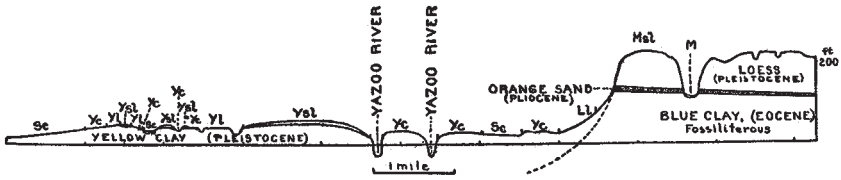


FIG. 12. Geological and soil section from bottom lands to upland, Yazoo County, Miss. Msl, Memphis silt loam; Ll, Lintonia loam; Ysl, Yazoo sandy loam; Yl, Yazoo loam; Yc, Yazoo clay; Sc, Sharkey clay; M, Meadow.

the main drainage courses of the bottom land. At greater intervals the larger drainage systems of the upland have cut broad bottoms or basins that open like amphitheaters out into the delta. Eastward from the crest of the escarpment the surface of the country consists of

ESCARPMENT OR BLUFF, WITH THE YAZOO RIVER IN THE FOREGROUND.

ween the uplands and the lowlands of the delta. The top of the escarpment is usually from 500 to 700 feet above the delta plain.

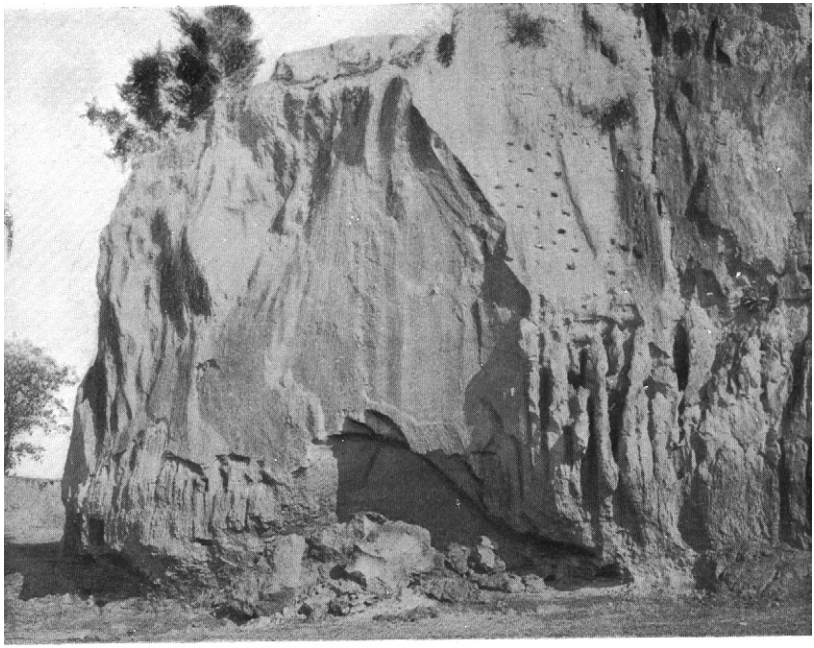


FIG. 1.—SECTION OF MEMPHIS SILT LOAM OR LOESS, SHOWING CHARACTERISTIC VERTICAL BLUFFS.

This loess stands for years in vertical planes or bluffs, having a very characteristic structure.

FIG. 2.—MEMPHIS SILT LOAM IN CANE HILLS REGION, SHOWING THE EXCESSIVE EROSION IN NEARLY LEVEL LAND.

The soil washes or seems to melt away, even with moderate rainfalls and on gentle slopes, and it appears to be impossible to prevent this with ordinary cultivated crops.

sharp ridges and cross ridges, separated from one another by narrow, steep-sided valleys. The crests of these ridges in the area covered by the map gradually decrease in elevation from the vicinity of the bluff toward the basin of the Big Black River. The crests also become broader in this direction. The valleys are not so deeply cut, and the sharp, serrated topography slowly sinks to the plateaulike topography of the Flat Hills region. (See fig. 12.)

The smaller streams which flow directly into the delta drainage system have cut back rapidly into the soft, unconsolidated materials of the bluff, and each of them has developed a small drainage system of its own, with a network of minor streams and gullies spreading out like the branches of a tree. Every member of each of these drainage systems cuts its valley deeper and removes more and more of the soft earth of the hill country each rainy season. As a result, a country which was originally nearly level has been carved by the eroding action of these streams into a rough and hilly topography such as marks the mature development of drainage systems. The region thus formed has long been known as the Cane Hills of Mississippi.

Farther to the east, where the descent of about 200 feet from the upland to the lowland is made by the streams, not in a course of 4 or 5 miles, but by a gentle flow of 20 miles or more, the cutting effect of the more gentle current has not been so pronounced, more of the original upland remains, and the resulting topographical difference is expressed in the local name for this region—that is, the Flat Hills.

The geological differences between the two portions of the area are as marked as the physical differences. Though in a geological sense the entire area is young, the materials which constitute the surface formations of the hill section are relatively much older than those forming the flood plain of the Mississippi River.

The geological section through the hill country from the surface of the earth downward is nearly uniform over all the region covered by the soil map. The surface material consists of from 20 to 40 feet of a fine yellow silt and of its weathering products. This material is not confined to this and adjoining areas, but extends from northern Iowa along the Mississippi River and its tributaries nearly to the Gulf of Mexico. It is marked throughout by a comparatively uniform silty texture, a yellowish or brownish-yellow color, a system of nearly vertical jointings or cleavages, which alone mar its massive structure, and by the presence of innumerable shells of the genus Helix, differing only slightly from those of the modern snail. These land shells, by the action of various solutions circulating through the silt, have been dissolved to a greater or less extent, and the lime thus derived has been built into curiously shaped concretions and nodules. This material was named "the loess" in the Rhine Valley, where it was first studied. It also occurs over extensive areas in central China.

The loess is underlain by a layer of orange-colored sand and gravel, the boundary between the two classes of material being sharply marked. There is no gradation from one to the other. The sand possesses a discordant stratification, lenses and layers dipping steeply in various directions and terminating abruptly against one another. Seams and pockets of gravel are scattered irregularly through the sand, occupying a position either at the top or the bottom or within the sandy stratum. In some instances the whole mass attains a thickness of 8 or 10 feet near the bluff, but becomes thinner toward the east. In the Big Black Basin the entire formation is frequently represented by a discontinuous band of coarse sand and fine gravel not over 1 foot in thickness.

The stratum of sand and gravel is underlain by a blue or yellowish-blue clay. The boundary between the sand and clay is again very sharply marked, and in many instances the gravel band sinks into hollows in the surface of the clay, conforming to the irregularities of its surface. The clay is jointed by a nearly rectangular system of cleavage cracks. It is waxy and plastic when slightly moist, slippery and unctuous when wet, and when thoroughly dry is consolidated to a bricklike hardness. There are found within the mass of this clay the remains of numerous marine shellfish, the largest specimens belonging to the genus Ostrea, together with the vertebræ of sharks and whales. In numerous instances where this clay is exposed at the surface masses and individual crystals of honey-colored gypsum can be seen. The depth to which this clay reaches was not ascertained, though the stream cuts along the bluff gave exposures of the clay to a point below the level of the surface of the delta.

Of these three geological formations the loess alone plays an important part in the origin of the soils of the upland. The sand and gravel are chiefly important as the sources of highway and building material. The clay, aside from scattered outcrops along the valley walls, plays no important part, except through the influence it exerts over the circulation of underground water.

The geology of the delta portion of the area is even more simple than that of the hill country. The Mississippi River and the minor streams of the Yazoo Delta, through inundations recurring at frequent intervals over a long period of time, have built up a broad, level bottom in the valley that the Mississippi had previously excavated through the older geological formations. This great river flood plain is of geologically recent date, and each succeeding inundation, even at the present time, adds new material and to some extent alters the arrangement of previously deposited sediments.

SOILS.

The following table shows the areas of the several soils mapped in the Yazoo area:

Areas of different soils.

Soil.	Yazoo sheet.	Mayersville sheet.	Total area.		Delta portion.
	Acres.	*Acres.*	*Acres.*	*Per cent.*	*Per cent.*
Sharkey clay	97,280	87,100	184,380	44.0	67.7
Memphis silt loam	140,090	.....	140,090	33.3	.....
Yazoo clay	24,400	20,680	45,080	10.7	16.6
Yazoo sandy loam	15,170	11,500	26,670	6.4	9.8
Yazoo loam	11,840	4,240	16,080	3.8	5.9
Meadow	4,760	.....	4,760	1.1	.....
Lintonia loam	3,060	.....	3,060	.7	.....
Total	296,600	123,520	420,120	.....	.....

The delta covers 425 square miles, or 64.8 per cent of the area surveyed. The Mayersville sheet is entirely in the delta; the Yazoo sheet is 50 per cent in the delta and 50 per cent in the uplands.

MEMPHIS SILT LOAM.

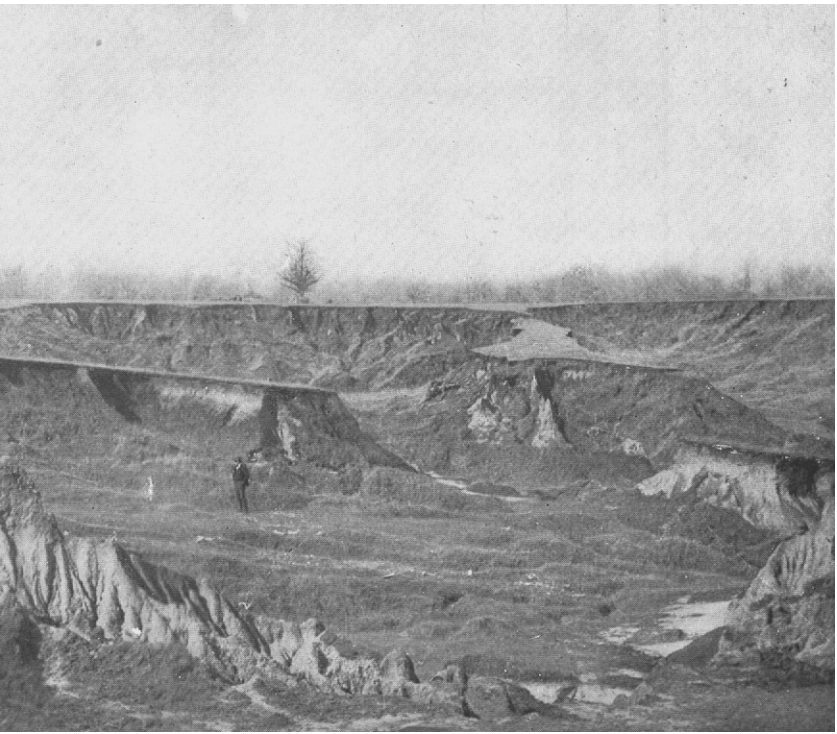
The Memphis silt loam is the principal soil type of the upland portion of the area. Its total area comprises 140,000 acres. It lies entirely within the upland. The surface of the region covered by this soil type is very hilly and broken. On the west it forms the crest of the bluff, and extends eastward in narrow ridges, which are connected with one another by irregular cross ridges. These ridges are separated by deep, steep-walled valleys, whose bottoms are formed by narrow strips of meadow land. The slopes of the valley walls are steep and very much dissected by small ravines and gullies. The slopes are usually forested, and the outlines in such areas are more undulating than over the cleared fields.

The differences in elevation between the crests of the ridges and the bottoms of the intervening valleys range between 50 and 150 feet. Near the bluff line the differences are sometimes greater. The general aspect of the region is that of a country where active erosion has developed a mature stream system by rapid cutting through unresistant materials. Weathering and the recession of the valley walls have not kept pace with the erosion and removal of material by the streams. The different stream systems are continually multiplying and extending the minor tributaries in the more remote upland, and in this region each system is doing its most active erosive work. This is due not only to natural causes, but also to the fact that the greater proportion of cultivated land is located in this same region. The operations of cultivation loosen the soil material to such an extent that the cultivated fields are very susceptible to washing unless carefully protected. Nearer the bluff line the minor tributaries have already been more fully

developed, the cultivated areas are smaller in proportion, and larger areas are protected by the presence of forests and through the prevalence of naturally sodded areas which have grown up to Bermuda grass and Lespedeza. As a result the outlines are more rounded and the erosion much less rapid near the crest of the bluff. However, all steep slopes, whether cultivated or forested, are apt to be badly washed during the rainy season.

The Memphis silt loam has been derived through the natural processes of weathering from a thick sheet of unconsolidated yellow silt, which extends far beyond the boundaries of the present area. This silt is known as the loess. Its origin is still a matter of discussion. It may have been a sediment deposited in quiet water, probably in the backset of a sluggish river course or of a large lake. On the other hand, it may have been wind-blown material, deposited either on land or in shallow water. The absence of pronounced stratification is a fact somewhat opposed to the idea of its formation as a water-borne sediment. The presence of the fossilized remains of land animals (Helix) would seem to indicate that some portion of the area was above water at the time when this sediment was deposited. On the other hand, if this material was deposited through the agency of the wind, its area of many thousands of square miles is one of the greatest ever formed in a similar manner. From these materials, in whatever manner they have been deposited, the slow process of weathering—that is, the action of impure subterranean water, of frost, of plant roots, and of burrowing animals—has formed a yellowish-brown loamy soil which grades imperceptibly into the raw material of the underlying silt. Where active erosion has taken place this soil has been removed. Over the remainder of the area its depth varies from 3 or 4 inches to 6 or 7 feet. The surface soil, or weathered zone, differs very considerably from the underlying material. The particles of the yellow silt consist of finely divided mineral matter which has not been reduced to a stable chemical composition. They thus form the raw material which may serve in the preparation of plant foods through further chemical changes. These foods are all present in the original silt, even in larger quantities than in the resultant loam. The chemical changes which are constantly taking place near the surface of the earth maintain the plant foods in available form in the brown loam. When that is removed through any cause these same chemical changes continue to prepare plant foods from the underlying soil. This process, though not capable of maintaining as high a fertility as existed in the weathered zone, is much more rapid than in the case of the majority of subsoils. This is due to the mechanical texture of the silt and to the fact that its particles have already passed through the first steps necessary for their preparation to support organic life.

The surface soil of the Memphis silt loam has an average depth of 8 to 12 inches. It consists of a brownish-yellow silty loam. It is



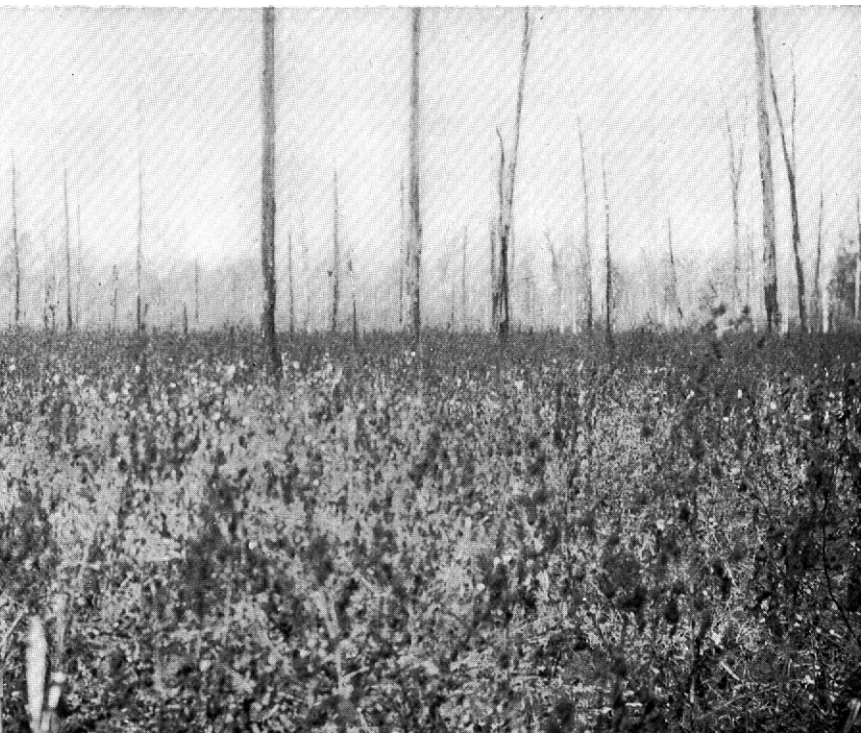
MEMPHIS SILT LOAM SHOWING EXCESSIVE EROSION.

lls region is badly eroded, even on the gentlest slopes, gullies with nearly vertical walls 15 to 30 feet
ed land with remarkable rapidity. The only efficient way to prevent this seems to be reforestation
Bermuda or Lespedeza.

PHIS SILT LOAM IN THE CANE HILLS REGION (FOREST GROWTH).

tain a very fine growth of oak and hickory, and such protected areas seldom wash badly.

BEECH GROWTH ON MEMPHIS SILT LOAM.



ETHOD OF "DEADENING" A FOREST TO START A CLEARING ON THE DELTA SOILS.

larger trees are simply girdled and allowed to fall of their own accord, in the meantime the land being cultivated to cotton.

somewhat more dense than silt, but is considerably more friable and coarse grained than clay. When moist it is very even grained and somewhat sticky, but is plastic only to a slight degree. In its dry state it is powdery and of a texture like well-ground flour. This soil is underlain by a chocolate-brown loam usually more compact and slightly less silty than the surface soil. There is no line of separation between the soil and subsoil, for one grades by slight degrees into the other. There is a sharp boundary between this weathered portion and the underlying silt. The soil and the subsoil of this type vary considerably in depth in different parts of the area. In the Flat Hills region they usually attain to a thickness of several feet, while in the Cane Hills region erosion has exposed the yellow silt over considerable areas and where it exists the soil is thinner.

The crop yields of the Memphis silt loam are quite uniform over the cultivated portions of both the Flat Hills and the Cane Hills regions, neither of which produces much more than one-half bale of cotton per acre even under the most favorable circumstances. The labor necessary to produce a bale of cotton is considerably greater in the Cane Hills than in the Flat Hills. This difference is due to the difference in topography more than to the difference in the fertility of the soils. In the Cane Hills region the roughness of the country and its susceptibility to washing have reduced the proportion of cultivated to uncultivated land to a ratio of about 1 to 4, while in the Flat Hills region the ratio is about 1 to 2. On this account the production of cotton per square mile of total territory is nearly twice as great in the latter as in the former. The cotton produced in both regions is almost exclusively short staple.

So far as texture and composition are concerned very little difference exists between the Flat Hills and the Cane Hills areas of the Memphis silt loam. The difference which has led to the separation of these two regions on the published map is one based upon topography and its consequences. Since the base map available showed no topographical differences between the two regions a boundary line was drawn to indicate it. In the Cane Hills region the rough, irregular topography gives rise to a set of conditions necessitating agricultural methods very different from those practiced upon the gentle slopes of the Flat Hills; the torrential rains of the winter season, amounting in some cases to a precipitation of several inches in a few hours' time, must continually cause an encroachment of the washed areas upon the cultivated land. Even the best systems of agriculture and the most constant effort can only retard and not prevent this encroachment. In the Flat Hills proper methods of cultivation are capable of maintaining or even of increasing the total area of tilled land, while in the Cane Hills permanent forestation or the permanent sodding of the entire area with Bermuda and Lespedeza can alone

prevent the continued washing of the soil. A large proportion of the area of the Cane Hills has already reached this condition. The hill slopes are timbered with an open forest growth, comprising white oak, red oak, post oak, hickory, beech, and other varieties. Where the denser portions of the forest growth are found the soil also supports a close sod of Lespedeza, which flourishes in the shade and furnishes admirable grazing during a considerable portion of the year. The open slopes are covered by Bermuda grass—another plant well suited to continued grazing—while many of the deeper gullies contain thickets of switch cane. Considerable tracts of merchantable timber, particularly oak and hickory, still exist, and proper methods of forestation would make this region a valuable timber reserve for the future needs of the State. Open forestation would interfere but little with the value of this extensive area as a grazing ground for cattle. The bottoms of the narrow valleys, which are included in another soil type, are capable of producing two or three crops of Bermuda hay a year, while the streams flowing through them furnish a water supply adequate to the needs of considerable numbers of cattle. The adaptability of this soil type to the production of alfalfa should also be thoroughly tested, for the introduction of stock raising as the principal industry of the Cane Hills region is worthy of serious consideration and extended effort. The fact that cattle can graze at large in this climate during ten months of the year is an additional reason for the introduction of the cattle industry.

The following table shows the texture of typical samples of the soil and subsoil of the Memphis silt loam:

Mechanical analyses of Memphis silt loam.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
6420	2⅛ miles east of Liverpool.	Yellow silt, 0 to 9 inches.	0.02	1.70	0.16	0.42	0.38	0.70	3.50	86.24	5.10
6416	10 miles southeast of Yazoo City.	Heavy silty loam, 0 to 10 inches.	.01	1.90	.12	.56	.30	.58	2.24	84.68	9.73
6418	9 miles south of Yazoo City.	Brown silty loam, 0 to 10 inches.	.01	2.54	.14	.30	.22	.32	6.38	72.74	16.19
6417	Subsoil of 6416....	Heavy loam, 10 to 40 inches.	.01	2.68	.28	.58	.40	.40	3.00	76.16	13.15
6419	Subsoil of 6418....	Silty loam, 10 to 40 inches.	.01	2.58	.38	.58	.70	1.04	5.26	75.36	13.95
6421	Subsoil of 6420....	Yellow silt, 9 to 40 inches.	.01	2.98	.18	.20	.08	.32	2.58	78.54	14.17

MEADOW.

The larger valleys occurring through the upland have been cut below the bottom of the silt along the lower courses of the streams, but nearer their headwaters, where the erosion is most rapid, the streams are still acting upon the silt and the narrow band of sand and gravel underlying it. Where the larger streams flow out from the hill country into the delta they have cut their valleys almost to the surface of the delta. For several miles back from the bluff they have also carved out flat-bottomed valleys, and during the winter rains they frequently overflow this narrow flood plain. A large proportion of the material brought by the tributary streams from the hills is deposited in these valleys and in front of the bluff line along the edge of the delta country.

This flood-plain material is deposited over a floor of the blue Eocene clay to a depth of 6 or 7 feet. The material itself consists of the yellow silt, the brown loam subsoil derived from it, and sand and gravel from the Lafayette formation. A considerable amount of organic matter is annually buried beneath fresh accessions of soil from the upland. The soils of these valley bottoms are constantly being formed by the deposition of this mineral and organic matter. They form a rich, well-watered, well-drained soil of limited extent and high agricultural value, though somewhat liable to destructive flooding at the time of the late spring rains.

The broader meadows are cultivated in small fields of cotton, corn, and cane, and the yield of each of these crops, unless affected by flood, is greater than in any portion of the upland. The cotton is of good staple and the product reaches 1 bale per acre. Corn produces about 30 bushels per acre, and small patches of cane have yielded at the rate of 300 gallons of sirup per acre, even when allowance was made for sufficient seed cane for the next year's planting. Small meadows located in these valleys produce 4 or 5 tons of the various grasses per acre in three cuttings. Where the valley is narrow, or the liability to flood constant, small pastures occupy the bottoms. In some places sycamore and poplar timber remains standing.

While the total area of these meadow lands is less than 5,000 acres, their productivity makes them an important soil type.

LINTONIA LOAM.

Where the delta country proper reaches back to the foot of the bluff there is a narrow strip of territory which belongs neither to the delta nor the upland. The friable silt forming the crest of the bluff is carried down both by stream action and the activities of the weather to form a gently sloping front or talus at the foot of the bluff. Where the streams are responsible for this spreading, the material comes to rest in low, gently rounded, conical slopes known as alluvial fans or

cone deltas. They rest upon the clay of the delta or against the Eocene clay at the base of the escarpment and constitute a separate soil type. The surface slope of these areas does not usually exceed a 15 per cent grade, and it is frequently so slight as to be barely noticeable.

The distinguishing features of this soil type consist of its depth and the peculiarities of its underdrainage. Like the meadow land, the soil is derived directly from the wash of the Memphis silt loam. It is not subject to annual additions of material as in the case of the Meadow, though new material is frequently brought down. There is no sharp line between the soil and subsoil in this type. It consists of a wedge-shaped sheet of yellowish or brownish silty loam, having a thickness of 12 or 15 feet near the base of the bluff and very gradually thinning out to a depth of less than 1 foot toward the delta. The water which falls on the areas of this type, together with that which falls along the front of the bluff and a considerable amount of that oozing out at the surface of the Eocene clay, flows through and under the soil in a small but continuous supply of seepage water.

The Lintonia loam is almost entirely under cultivation, and in some cases the yield of cotton reaches 1½ bales per acre. It is also cultivated to corn and cane. Owing to its elevated position along the margin of the delta it is rarely submerged during inundations. It is, however, sometimes subject to small local floods from the overflow of streams flowing down from the Cane Hills. This soil type is adapted to the production of grass, oats, garden vegetables, Irish potatoes, strawberries, raspberries, pears, and peaches, in addition to the staple crops—corn, cane, and cotton.

The following table gives the mechanical analyses of samples of this soil:

Mechanical analyses of Lintonia loam.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
6414	5 miles S. of Yazoo City.	Yellow silty loam, 0 to 8 inches.	0.04	3.18	0.24	0.22	0.68	1.28	11.98	78.92	3.56
6415	Subsoil of 6414....	Brown silty loam, 8 to 40 inches.	.03	2.54	.....	.32	.28	1.04	11.40	80.32	4.33

YAZOO SANDY LOAM.

The Yazoo sandy loam occupies long, low ridges extending along the margins of the principal stream courses of the delta portion of the

area. The ridges form the front lands and rise from 10 to 15 feet above the general level of the delta. They are thus drained in two directions.

The Yazoo sandy loam is usually found occupying the crest of the ridges and grading off in both directions, toward the stream and toward the low-lying central areas, through a loamy margin into a dense, waxy clay which forms the greater part of the surface of the delta. Usually the areas are several times as long as they are broad. Near the sharper bends of the streams the single area is apt to split up into several nearly parallel strips separated from one another by narrow, low-lying bands of clay.

All of the soils of the delta region have been formed by the same agency. The Mississippi River established its course over this land area when it was first elevated above tide level, and it has ever since been broadening and building up its flood plain. As the banks were cut away their soil, together with contributions from confluent streams, was carried farther downstream and deposited at times of overflow in the flood plain or continuously as a delta deposit below tide water.

The soils of the region as they exist at present are all of alluvial origin, and are subject to frequent additions by deposition from overflow waters.

During periods of inundations the swollen currents of the Yazoo River and of other smaller streams cut into the bluff silts, sands, and clays at numerous points and remove the greater part of this material along the lines of the most rapid currents. These lines are naturally found near the main stream channels. The current in the channel proper is swift enough to carry all the sediment, but where its velocity is checked along the banks, and especially where the current leaves the main channel and attempts to force a passage across bends in its course, the slack water deposits the larger particles held in suspension. The greater part of this deposition thus occurs near the stream channels and the coarser material is deposited in this first checking of the current. In this manner the sands and silts are built into natural levees along the river courses, while the clay is carried out into the open country between stream courses and deposited. The rate of deposition is much more rapid near the streams, the materials are coarser, and the changes from rapid to slow current occur more frequently, thus giving rise to the formation of bars of sediment rather than to the uniform deposition of a thin sheet of material.

The component particles of the Yazoo sandy loam consist of fine grains of quartz sand and mica mingled with finer particles of silt and clay. These mineral particles have first been weathered out to a state of relative chemical simplicity in their original locality and then thoroughly washed and sorted while being transported to their present

position. Only a small amount of organic matter is deposited with the mineral particles. The actual plant foods of this type are found in the finer silt or clay particles, which give it its loamy character, and in the organic material incorporated in the soil by the growth, death, and decay of vegetation produced upon its surface.

The Yazoo sandy loam consists of a medium to fine sandy loam soil, having an average depth of about 8 inches, and underlain by a brown loamy sand containing organic matter, silt, and clay. The latter has a depth ranging from 6 inches to 10 inches and is usually underlain by several feet of fine yellow sand, only slightly loamy. Near the margins of the larger areas of this type, and in the smaller areas, the subsoil is frequently more dense, even becoming sticky bluish clay. This is due to the fact that during the later inundations a thin layer of sand has been spread out beyond the former limits of the bar, encroaching upon the clays of the interior areas.

The Yazoo sandy loam is uniformly well drained, is favorably located near streams capable of furnishing water transportation for the crops raised, and, at least on the higher portions of the ridges, lies well above the level of any but the most general inundations.

At present the Yazoo sandy loam is almost exclusively devoted to the production of cotton. This type was usually chosen by the pioneers of the region for the beginning of agriculture largely because of its location along the waterways and its slight elevation above the general level of the country. As a consequence the older plantations of the delta region consist extensively of this soil type. Some areas of Yazoo sandy loam have been cultivated continuously for fifty or sixty years with little or no restoration of fertility through fertilizers. These older areas produce about one-half bale of cotton per acre, while areas brought under cultivation more recently produce about three-fourths bale.

This soil, on account of its porous nature, is subject to more rapid deterioration than the more clayey soils, and it is perhaps due to occasional fertilization by inundation that this soil has been able to maintain its producing capacity to the extent it has.

In addition to cotton, a small amount of corn is raised on the Yazoo sandy loam, while the little garden patches around the cabins of the field hands produce sweet potatoes, Irish potatoes, beans, peas, cabbages, and other vegetables for home use.

The physical properties of this soil, together with its admirable drainage and its favorable location near navigable streams, fit it for the production of truck crops for the Northern and Eastern markets as well as for local consumption. Early Irish potatoes can be harvested by the 1st of June upon this soil, and the yield of small patches would indicate that a profit of $200 per acre might be secured under average conditions of production and market. If placed under intensive cultiva-

tion, with well-chosen and adequate fertilization, much larger profits could be derived from early strawberries, peas, melons, sweet potatoes, and tomatoes. Even those crops most sensitive to injury by frost might be produced with cheese-cloth protection, such as is used for producing Sumatra tobacco in the Connecticut Valley.

In the process of adaptation of special crops to different soil types, which must gradually arise with the more extensive development of the delta country, the Yazoo sandy loam should become less and less a cotton-producing soil, and be more and more devoted to the early truck and market-garden crops which derive a large part of their value from reaching a high-priced market at an early season. In order to produce the best results the areas of Yazoo sandy loam should be farmed in small tracts, under an intensive system of cultivation. The use of fertilizers and leguminous crops is now necessary to produce adequate results from this soil.

The following table shows the texture of the Yazoo sandy loam:

Mechanical analyses of Yazoo sandy loam.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
6452	¼ mile E. of Maysville.	Sandy loam, 0 to 8 inches.	0.02	1.58	0.00	1.16	0.30	9.54	47.62	36.90	2.84
6450	Brevoort.....	Fine yellow sand, 0 to 10 inches.	.01	1.82	.00	.40	.34	5.32	43.68	44.18	4.31
6446	2½ miles SW. of Craig.	Fine sandy loam, 0 to 8 inches.	.01	1.46	.38	.84	.76	1.36	20.36	70.14	4.53
6444	2 miles S. of Egremont.	Sandy loam, 0 to 8 inches.	.03	3.40	.00	1.28	1.38	1.68	19.54	69.18	6.09
6448	4 miles SW. of Yazoo City.	Sandy loam, 0 to 8 inches.	.06	2.18	.38	.68	.56	7.38	38.62	44.68	6.10
6451	Subsoil of 6450....	Fine loamy sand, 10 to 40 inches.	.01	2.58	Tr.	.38	.28	5.02	32.88	54.06	4.55
6453	Subsoil of 6452....	Yellow sandy loam, 8 to 36 inches.	.05	2.84	.00	.00	.14	.46	11.82	78.18	6.83
6447	Subsoil of 6446....	Brown clay loam, 8 to 36 inches.	.01	3.06	.00	.44	.42	2.30	27.42	58.78	7.87
6449	Subsoil of 6448....	Yellow sandy loam, 8 to 40 inches.	.02	2.86	.00	.50	.48	8.72	27.58	50.30	9.94
6445	Subsoil of 6444....	Yellow sandy loam, 8 to 40 inches.	.02	2.94	.00	.14	.36	2.36	17.34	64.72	12.58

YAZOO LOAM.

Lying along the margins of the Yazoo sandy loam, the Yazoo loam forms an intermediate type between the sandy soils of the ridges and the heavy clays of the interior. This soil has been formed by the processes explained in the discussion of the Yazoo sandy loam, except that the materials forming it were deposited in slower currents, farther removed from the main stream channels.

The surface of the Yazoo loam is only gently sloping and nearly flat. The areas form narrow bands or small irregular patches near the stream courses. The larger areas all occur near the bluff line, or at a point below where the main streams are engaged in active erosion against the bluff. This fact and the close similarity of the soil particles in size and in material to the yellow silt of the bluff lead to the belief that the Yazoo loam has been formed by the spreading out of a thin layer of this silt over the margins of the open land of the delta at times of inundations.

The soil of the Yazoo loam consists of a fine yellow or brown silty loam, having a depth of 6 to 8 inches. It is loose and powdery when dry and somewhat sticky when wet, though lacking any real plasticity. It does not bake or sun crack to any marked extent, and is thus capable of being cultivated at almost all seasons of the year. The subsoil consists of a heavy drab clay, quite plastic and waxy. This extends from a depth of 8 inches to a maximum depth of 10 or 12 feet.

The Yazoo loam is one of the strongest and best cotton soils of the delta country. A good stand can be secured nearly every year, and the average yield amounts to from three-fourths to one bale of good staple cotton per acre. It also produces a good yield of corn—25 to 40 bushels per acre.

In addition to these crops the Yazoo loam is capable of producing cabbages, cucumbers, tomatoes, peas, and Irish potatoes, and would form a valuable type for the raising of grass or grain crops in connection with general farming. It is well drained and subject to overflow only at times of the general inundation of the delta.

Mechanical analyses of this soil are shown below:

Mechanical analyses of Yazoo loam.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
6440	¼ mile NW. of Campbellville.	Silty loam, 0 to 8 inches.	0.01	2.32	0.14	0.32	0.38	2.06	16.14	73.10	5.99
6438	Brevoort	Silty loam, 0 to 6 inches.	.01	2.68	.72	.94	.58	2.56	34.24	48.26	9.91
6442	2 miles SW. of Yazoo City.	Silty loam, 0 to 7 inches.	.01	2.58	.28	.88	.72	3.74	19.58	62.76	9.91
6441	Subsoil of 6440....	Brown clay loam, 8 to 40 inches.	.01	4.86	.20	.18	.16	.78	11.10	71.30	11.53
6439	Subsoil of 6438....	Silty loam, 6 to 36 inches.	.01	3.34	.40	.48	.28	1.44	20.52	59.20	14.31
6443	Subsoil of 6442....	Yellow clay, 7 to 36 inches.	.01	3.56	.04	.20	.22	1.40	11.60	56.24	26.59

YAZOO CLAY.

The Yazoo clay occupies the low-lying borders of the front lands and the higher ridges through the open country between streams. The Yazoo clay and the Sharkey clay owe their origin to the same process of deposition. They both occupy the extensive flats lying between the natural levees found along the major stream courses. During the inundations of the delta country the coarser materials are deposited in considerable quantities along the stream courses, forming the bars or ridges already described. At the same time the finest particles of clay, which can be held in suspension by slowly moving water, are carried farther away from the streams to the interior.

It is a matter of demonstration experimentally that clay particles of the size forming the Yazoo and Sharkey clays may remain in suspension in quiet water for many days or even months.

So, when the backset waters of a general inundation are held in from the main water courses by the ridges along the streams, there are several reasons why all the material they hold in suspension is deposited in a broad, uniform sheet of clay. In the first place, the sandy ridges of the front land so inclose the flood water that the greater part of it, though finally reaching the local streams, is completely filtered out in its passage through the ridges. In the second place, this drainage takes place so slowly that few currents are set up in the water mass,

and the natural settling of the suspended sediments is carried on almost undisturbed for a long time. In the third place, a large proportion of this flood water is evaporated, and of course all of its sediment is left behind. In this manner the Yazoo and Sharkey clays represent the same conditions of sedimentation in a large natural catchment basin.

The slight irregularities of surface in the open interstream regions represent the erosion and deposition taking place at those rare intervals when some stronger current has cut across from one drainage system to another during a particularly deep inundation.

The Yazoo clay consists of a drab or bluish clay soil having a depth of about 5 inches. This is underlain by a lighter colored waxy clay to a depth of several feet. The surface soil is very stiff and sticky when wet, showing the plastic properties of a true clay. As it dries out the soil particles are drawn close together, forming large or small compact masses. In many cases sun cracks form to a depth of several inches, and the surface is divided up into polygonal blocks. If the cracks are nearer together small masses result, which give the soil a sandy or pebbly character during dry weather. From the color and size of these clay masses certain portions of the Yazoo clay, particularly areas found in Sharkey and Issaquena counties, have been called "buckshot" soil. Other areas in which this phenomenon is not so fully developed are locally said to be "bucky" in character, though not forming typical buckshot lands.

This peculiar coagulated condition of the surface soil exists only under conditions of average dryness. When the buckshot mass becomes moistened by fall rains the grains melt down to a fairly homogeneous mass and do not reassume their characteristic state until the next season.

The Yazoo clay is a fertile, productive soil, but one requiring great care in cultivation. If the spring plowing is done when the soil is just at the proper stage of saturation the soil turns easily and becomes quite loose and friable during the cultivating season. Under these conditions a good stand of cotton is secured, the crop matures a large proportion of the bolls set, and a yield of 1 bale per acre, or even more, is obtained. If the Yazoo clay is plowed when too wet it simply sinks back into a solid mass, and the surface on drying becomes compact and solid. The crop suffers and cultivation is difficult. If, on the other hand, plowing is delayed until the fields have partly dried out at the surface, only long rows of bricklike clods are turned up, and the soil is as intractable as a bowlder-strewn field in a glaciated area.

The greater number of cultivated fields on the Yazoo clay should be improved by more frequent drainage ditches. Open cuts rather than tile drains should be used, as the subsoil is so impervious that the cost of an adequate amount of tiling might easily exceed the value of the land. The drainage outlet, owing to the higher elevation of the front

land, must usually be into the open forest land of the interior or into local hollows and sloughs.

In addition to the cotton crop, the Yazoo clay may be made to furnish grass and grain crops for the feeding of plantation stock or for raising cattle. It is one of the most valuable of the cotton soils of the delta country and seems destined to produce still larger proportions of the total crop.

The texture of typical samples of this soil is given in the subjoined table:

Mechanical analyses of Yazoo clay.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
6436	3 miles SW. of Lake City.	Clay loam, 0 to 6 inches.	0.02	4.44	0.54	0.54	0.54	2.16	5.94	66.92	19.14
6434	2¼ miles SE. of Mayersville.	Clay loam, 0 to 6 inches.	.02	4.54	.58	.80	1.40	8.10	10.28	53.12	21.00
6432	1 mile SW. of Yazoo City.	Clay loam, 0 to 6 inches.	.01	4.92	.36	.58	.66	2.34	5.50	57.22	28.29
6430	One-half mile N. of Egremont.	Sticky clay loam, 0 to 6 inches.	.03	6.20	.00	.12	.20	1.48	3.84	59.06	29.05
6437	Subsoil of 6436....	Waxy gray clay, 6 to 36 inches.	.01	3.62	.18	.54	.40	2.36	10.58	60.10	22.51
6431	Subsoil of 6430....	Waxy drab clay, 6 to 40 inches.	.02	4.10	.12	.36	.96	3.40	9.02	57.56	24.34
6433	Subsoil of 6432....	Waxy yellow clay, 6 to 36 inches.	.01	5.10	.00	.18	.26	1.02	2.20	39.50	51.65
6435	Subsoil of 6434....	Heavy drab clay, 6 to 40 inches.	.01	4.04	.12	.30	.26	.68	3.00	1.38	19.05

SHARKEY CLAY.

The Sharkey clay is the most extensive soil type of the delta region, comprising about two-thirds of the area. It occurs in large, irregular areas between stream courses and forms a central basin-shaped depression below the ridges of the front land.

The Sharkey clay represents the undisturbed settling of the finest clay particles brought into the delta during periods of general overflow.

The manner of its deposition has been outlined under the discussion of the Yazoo clay. The Sharkey clay lies so near the level of the delta streams that it is permanently saturated at a few feet depth during a large part of the year. Its low-lying position also causes it to

become water-soaked early in the winter and to remain so late in the spring. In addition to this saturation through normal precipitation its low situation also subjects it to more frequent inundation than the front-land soils. Large portions of the Sharkey clay are overflowed annually, while all parts of it are covered about once in eight or ten years.

The Sharkey clay consists of a waxy yellow clay soil, which is sun cracked to a depth of 5 or 6 inches wherever the bare surface is exposed to direct sunlight during the summer months. This is underlain by a massive, waxy yellow clay subsoil to a depth of several feet. In some cases a layer of sand, underlying this clay, can be found within 4 or 5 feet of the surface.

The Sharkey clay is almost entirely forested. The forests are open, largely free from undergrowth, and consist of white oak, overcup oak, red oak, Spanish oak, water oak, sweet gum, and ash, with cypress in the hollows and sloughs. The undergrowth consists of cane thickets on the higher lands and palmettos near the margins of the forests. The timber values in this region have not reached a high point, and the future timber resources of the State lie extensively in the hard-wood forests of the delta.

The Sharkey clay has been built up by slow accumulations of mineral matter carried by the flood waters from the upland portions of Mississippi and several other States. It represents the accumulations of thoroughly prepared soils carried off from the hill country to the advantage of the alluvial plain. Buried by each successive layer of this mineral matter are considerable amounts of leaf mold and other organic matter derived from the local forest. This combination of materials produces one of those alluvial soils universally esteemed for fertility and durability. In addition, the periodic inundation of the Sharkey clay areas brings new supplies of soil material for frequent renewals of fertility.

On the other hand, the soil drainage is at present entirely inadequate to free the soil of excess moisture in time to produce the long-season crops raised in the region. Moreover, any season may be one when a general inundation will flood the Sharkey clay to a depth of 6 feet or more until the first of June or later.

One of the most difficult problems of agriculture in the area is found in the question of the proper method of utilizing this soil type for purposes of crop production. The problem, which is one of agricultural engineering rather than one of farm technology, is to so dike and drain the areas of Sharkey clay as to render them suitable to the crops now raised or to secure crops which may be raised in a short, late season after the soils have reached a condition favorable to tillage.

The question of draining off the surplus precipitation may be solved,

GROWTH OF PALMETTO ALONG THE MARGIN OF SHARKEY CLAY.

Found only at the margin and rarely penetrates the open hard-wood forests of the Sharkey clay.

as in the Louisiana cane fields, by the excavation of deep, broad ditches with smaller, more frequent laterals which would facilitate the natural drainage. Even in case this alone were insufficient, valuable crops like cotton, cane, or rice could be further guarded by pumping systems, such as are employed in Holland.

The case of general inundation can only be guarded against by a general system of levees developed along the minor streams in the manner of those which shut out the main flood waters of the Mississippi River or the tide waters along the meadows of the New Jersey coast. Either State or national aid, or at least the use of large private means, is necessary to secure such a dike system.

As the areas of Sharkey clay are improved to form agricultural lands it will become necessary to construct a much greater mileage of highways and of railways than exists at present in the open forest area. It would seem desirable so to locate the main roadways that the embankments necessary for their construction might form part of the levee system desired to protect the lands, while the excavations made in building these embankments should form part of the drainage-ditch system.

The fertility of the Sharkey clay is unquestioned. The balancing of the items of expense necessary to make this fertile type available against the results to be obtained can alone determine how much of the type could be profitably drained and at what time this can best be done.

The subjoined table exhibits the texture of typical samples of this soil.

Mechanical analyses of Sharkey clay.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
6428	4 miles SW. of Craig.	Clay loam, 0 to 6 inches.	0.01	5.26	0.16	0.30	0.38	1.30	3.70	68.62	20.55
6424	8 miles SW. of Yazoo City.	Waxy yellow clay, 0 to 6 inches.	.01	4.60	.34	.30	.34	1.96	7.10	57.72	27.71
6426	2 miles W. of Lake City.	Waxy yellow clay, 0 to 6 inches.	.01	5.96	.12	1.12	1.26	2.68	1.24	41.28	46.81
6429	Subsoil of 6428....	Waxy yellow clay, 6 to 32 inches.	.01	3.84	.18	.62	.42	.92	2.94	70.08	21.01
6425.	Subsoil of 6424....	Waxy yellow clay, 6 to 36 inches.	.01	5.76	.14	.28	.78	1.76	1.78	41.64	47.43
6427	Subsoil of 6426....	Waxy gray clay, 6 to 36 inches.	.03	6.40	.00	.10	.26	.26	.72	24.40	67.35

AGRICULTURAL CONDITIONS.

The Yazoo area forms a portion of the United States whose almost exclusive interest is centered in agriculture and the pursuits and industries most closely dependent upon agriculture. Moreover, during the past three-quarters of a century the agriculture of the region has been developed along the line of an extensive cultivation of a single crop—the great staple, cotton.

The State produces from 1,250,000 to 1,500,000 bales of cotton per year, and its total production is exceeded regularly by but one other State—Texas. Different States may produce as much cotton for a single year, but Mississippi's normal rank is second in the list.

All portions of the State take part in the production of the crop. The prairie region, the hills, and the delta each contribute. The yields per acre, the methods of making the crop, the culture, and the varieties grown vary with the locality, but the one great end of agriculture in the State is to cultivate the largest possible number of acres in cotton and to secure the heaviest yield.

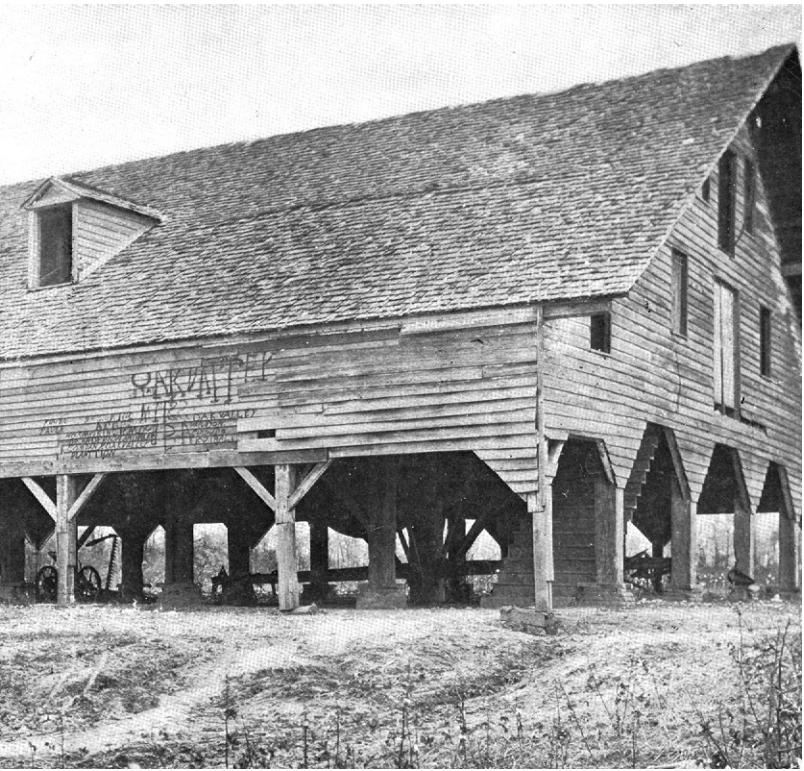
The Yazoo area is as distinctly divided into two different cotton regions as it is into two different physical divisions. In fact, the physical differences are the cause whose effects are noticed in the differing character of the population, of the agriculture, and of the transportation facilities.

In the upland country the farms are of smaller size and are more generally cultivated by their owners than in the delta region. Transportation by wagon to the nearest railroad point and shipment by rail from that point is the common method in the hill region, while in the delta the crop is frequently loaded from the gin directly onto the steamer or barge which is to carry it to one of the larger markets.

In the upland region a single steam cotton gin handles the crop for several adjoining farms, while in the delta all of the larger plantations gin out their own crop. In the hill country the proportion of negro to white population is about the average of the region, while in the delta the preponderance of the negro race in numbers is marked.

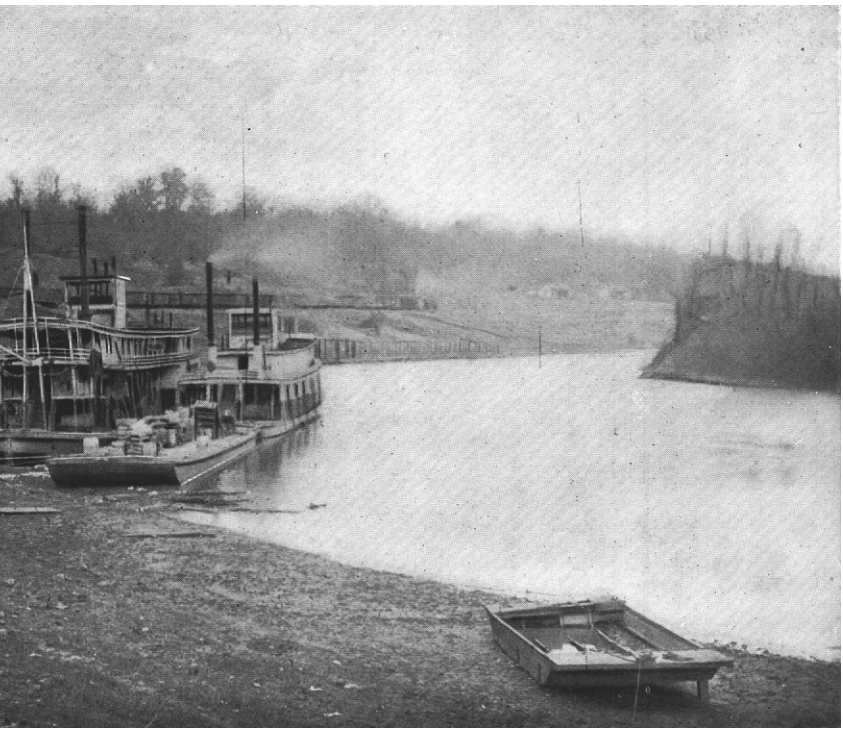
In both regions the one great crop is cotton. In the hill country corn and sugar cane are also raised to some extent. In the delta few plantations regularly produce sufficient corn to feed the work stock and very little cane is raised.

In the hill country from one-fourth to one-half of the area is under actual cultivation, the remainder of the land furnishing grazing at almost all seasons of the year. It also supports an open forest growth of oak, hickory, beech, and poplar. In the delta from one-third to one-half of the area is cultivated, the plantations lying near the main stream courses, while the remainder of the area consists of low-lying timbered lands, sometimes called the open swamp. The forest consists of several species of oak, gum, and cypress.



-POWER COTTON GIN, STILL USED TO SOME EXTENT IN THE DELTA REGION.

rea have their own gin houses, a few of these old-style gins remaining, but the remainder are of more modern construction, run by steam power.



ANDING ON THE YAZOO RIVER, SHOWING METHOD OF TRANSPORTING COTTON.

Yazoo River, but the flat-bottomed steamers come directly up to the bank of the plantation to load the cotton.

The following tables show an interesting variation in conditions of agriculture. Issaquena and Sharkey counties lie entirely within the delta region, while over one-half of Yazoo County lies in the hill country.

Farm statistics.[a]

SIZE AND CONDITION OF FARMS.

County.	Total number of farms.	Total number of acres.	Acres improved.	Acres unimproved.	Number of acres to the average farm.	Average number of acres improved.	Average number of acres unimproved.	Per cent of land improved.
Issaquena	1,763	107,604	68,837	38,767	61	39	22	64
Sharkey	936	186,562	44,994	141,568	199	48	151	24
Yazoo	3,761	466,530	211,424	255,106	124	56	68	45

CONDITION OF TENURE.

County.	Cultivated by owner.	Cultivated for money rent.	Cultivated for share of products.
	Per cent.	*Per cent.*	*Per cent.*
Issaquena	13.78	4.94	81.28
Sharkey	13.35	39.00	47.65
Yazoo	28.16	25.50	46.34

[a] Eleventh U. S. Census.

Many of the smaller farms scattered through the hill country are owned by the same proprietors, though constituting separate farms, while in the delta country the holdings of a single owner are more frequently contiguous and joined under a single plantation name and management.

The distinctive method of farm management is the subdivision of the farm or plantation into small tracts, or "cuts," which are all under the supervision of a single manager, but are farmed on the share system by colored laborers. A one-horse, or mule, cut comprises 12 to 20 acres; a two-horse cut about double that amount. A single family can run the smaller cut, while outside labor must be hired on the larger tract. The owner in each case furnishes all tools, the work animals and their feed, and usually the seed. The laborer furnishes only the subsistence for himself and family, with that of any hired hands. The owner has first lien on the matured crop, while the merchant who furnishes the provisions for the renter has a second lien, commonly secured by mortgage on the crop. The renter receives the balance when the crop is sold. He may secure abundant returns for his labor, or find himself in debt, depending more on his forethought and prudence than on the actual crop returns in a normal year. In other words, his earning capacity most commonly exceeds his ability to save.

It is a frequent practice on the part of land owners to require each tenant to raise 1 acre of corn, or equivalent forage, for every head of

work stock employed. But the larger plantations also raise their own corn on reserved land by the work of hired hands. The planter commonly furnishes the fertilizer—cotton-seed hulls or meal—when any is used, and the maintenance of drainage ditches also devolves upon him.

An acre of land, renting for $3 to $9 per acre, will produce from three-eighths bale to 1¼ bales of cotton in the Yazoo area. The cost of cultivation, team, and implements is about $5 per acre; the cost of ginning, $2.50 per bale. The yield will give 2 pounds of seed to 1 pound of lint, whatever the total production. The expense of cultivating lands does not decrease at as rapid a ratio as that of the decrease of returns. Below a yield of one-half bale of cotton per acre there is a bare profit in cotton culture on the rent system, even with 8-cent cotton. With a yield of 1 bale per acre there is a good return, the expense not increasing proportionately to the yield.

This deduction is of considerable importance, on account of its bearing on the present status of agriculture in Mississippi. In the Cane Hills region of the Yazoo area cotton production has sunk to or below a one-half bale yield. Any greater yield is fortuitous, depending on a particularly favorable season, or on more expensive culture, involving an outlay for fertilizers. Moreover, only 25 per cent of the region is actually producing cotton, 75 per cent being in forest or grazing land. All of the land is taxed, however. The region must change its system of agriculture or the population must be satisfied with a struggle for existence rather than with the prospect of an adequate reward for its labors. No class of people are more devoted to their homes or more willing to work for their own maintenance, so it would seem that a change in methods would be the only solution of the case.

The Cane Hills region possesses a fertile soil, which under continued cultivation is subject to increased washing, but under sod or in forest remains uneroded. Bermuda grass and Lespedeza grow wild, while the common varieties of clover thrive. A test should be made of the adaptability of alfalfa to this soil and climate. The oil mills of the region produce thousands of tons of cotton-seed hulls and cotton-seed meal, while the open meadows along the stream bottoms produce from 3 to 4 tons of various kinds of hay. When the advantage of a climate which is only severe for a few days at a time during two months of the year is added, the Cane Hills region seems most admirably fitted for the raising and fattening of stock. The absence of a near-by market would make the region less promising as a butter or milk producing territory, but modern methods of manufacture, packing, and shipping allow of a profit, even with distant markets.

This region is also adapted to several fruit industries, though as yet these have not been developed. The famous vineyards of the Rhine Valley are located on a loess soil almost identical with the Memphis silt loam. With proper care in the adaptation of the varieties to the climate

grapes should succeed along the entire bluff. The wild vines have always flourished there. Peaches, pears, and plums are also suited to the soil and climate, and their culture has met with considerable success in other localities in the State.

The Flat Hills region of the Memphis silt loam is still in condition to yield fair returns to cotton cropping, but care must be exercised in the cultivation of the lands or the boundary between this and the Cane Hills region will steadily migrate eastward. More attention should be paid to the renewal of the fertility of the land, for which cowpeas would be of as great value as any one agent.

In the delta region the Yazoo sandy loam is already showing the effect of continued cultivation to cotton. The weed is smaller and the crop less over many areas than ever before. Fertilization with cottonseed hulls and the production of cowpeas will help to correct this tendency. A specialization in agriculture involving the devoting of part of the area of this type to the production of truck should yield better results than the continued exclusive cultivation of cotton. The small patches of sweet potatoes, Irish potatoes, watermelons, canteloupes, and peanuts raised by some of the field hands demonstrate the adaptability of this soil to truck growing. The soil rarely freezes, the sandy ridges are all well located near main highways and along stream courses, and they are all well drained and subject to overflow only at long intervals. Other sections of the State no more favored by nature are deriving considerable profit from the production of strawberries, green peas, green sugar corn, sweet potatoes, early Irish potatoes, watermelons, canteloupes, raspberries, and other crops which yield the greatest profits by reaching an early market.

The Yazoo loam and Yazoo clay are fertile soils well adapted to the production of large and profitable cotton crops. The chief necessity attaching to their cultivation is that of providing more adequate drainage. The present system usually comprises a few shallow, open ditches leading from the margins of the front land back into lower-lying forest areas. Even these are not kept well cleared. Some larger drainage systems leading across the front-lands to the main streams have been undertaken, but the open ditches have rapidly developed into deep gorges, which interfere not only with cultivation, but also with the public highways. The excessive washing which has so often led to the abandonment of these large ditches may be prevented. The final fall from near the crest of the frontal ridge should not be made by an open ditch, but by means of a large-size tile drain buried many feet deep, with the outlet near the normal summer level of the water course into which it empties. The excessive erosion accompanying the use of the open ditch is largely due to a steep grading from the highest point of the front land to the water course. In some cases this grade has been distributed along the entire length of the fall. In others the

grade was made gentle to the bank of the stream and a vertical drop left at that point. The latter form produces a small waterfall, one of the most effective means of deepening and broadening a ditch into a ravine. The soft nature of the soil materials renders necessary the lining of any main ditch with terra-cotta tiling or iron pipe in order to prevent washing.

The Sharkey clay presents a subject of great interest. Its area comprises over 65 per cent of the delta porton of the Yazoo area and a larger proportion of the Sharkey-Issaquena area. At present this soil type is largely occupied by the original forest growth, and throughout its area it is undrained, unimproved, and subject to annual overflow. The higher portions of the type, comprising small, scattered areas, are not so frequently overflowed, but they still constitute a region not so favorably located as the front lands.

The question of the utilization of these lands is one involving extensive outlays of capital for drainage and diking, and any adequate discussion of these problems must follow a careful study of levels, flood records, and cost of dike construction. Since not even a proper map exists to show the location of streams, paths, bayous, and lakes, and as no data are obtainable regarding variations of level, it would seem necessary to first secure a good topographical map with accurate level lines, and next to consider each separate tract as an independent problem in hydrographic engineering. It may be stated as a fact of general observation that 90 per cent of the total area of the Sharkey clay is annually covered with water to a depth averaging about 3 feet during the larger part of March, April, and May. During the great periodic overflows, when even the front lands are covered, the depth of water over the Sharkey clay is much greater. The soil is fertile, and cotton, cane, and rice can be raised under the soil and climatic conditions prevailing, provided the floods can be kept off, or the lands drained.

Inundations of a more or less general character occurred in 1815, 1828, 1844, 1849, 1850, 1851, 1858, 1859, 1862, 1865, 1867, 1874, 1882, 1884, 1890, 1893, and 1897. Of the more recent of these floods those occurring in 1858, 1882, and 1897 were more extensive and affected the area under consideration to a greater extent than those of other dates.

The loss incident to a flood is dependent not only upon the absolute elevation of the water, but also upon the duration of its stand above the danger line. Thus, in 1874 the river was above the danger line at Vicksburg for a period of 83 days; in 1882 it was above the danger line 162 days; in 1884 for 107 days; in 1890 for 126 days; in 1893 it was above the danger line in two periods for a total of 76 days; while in 1897 it was above the danger line for 80 days.

The lower portion of the Yazoo delta is affected by inundations in

two ways. The breaking of the levees along the Mississippi may allow large volumes of water to sweep over the cultivated fields, filling the open country and destroying stock and even human beings by its sudden advent. No foresight or precaution can completely prevent such occurrences. In addition to the immediate destruction, breaks in the levees usually give rise to quite extensive changes in the soil surface. Considerable deposits of river sand, derived from the undermined banks, are left over the adjacent plantations, or a particularly swift current may excavate a bayou or lake bed, rendering wide areas unfit for agricultural purposes.

Less violent and less destructive of life, the other form of inundation usually produces more far-reaching effects and more lasting results. As the Mississippi River rises, the elevation at which the tributary streams can empty their drainage rises, their waters are forced back, their currents checked, and water from the Mississippi encroaches on their drainage area. A slow universal filling of the open forest country ensues, and the higher cultivated front lands, with their dwellings, their implements, and their stock, stand out as long, detached islands, fronted by a turbid river current and backed by a broad, shallow lake. If the inundation is extremely high, or of long duration, it gradually encroaches on the front lands, and the inhabitants and stock must be removed to the bluff country or huddled together on the mounds erected by the ancient inhabitants of the valley.

General inundations, whether produced by one or the other of these causes, lead to changes in the soil characteristics of the region by the addition of new material from outside sources or by the redistribution of local matter. They affect the life and property of the inhabitants; but they affect most seriously of all the planting and production of the universal crop.

The inundations may begin at any time from the latter part of January to the latter part of March, and floods have lasted as late as July 1. This is very exceptional, however. Occurring during the season devoted to the preparation of the land and to the planting of the crop, the floods delay, or prevent, agricultural operations and exert a widespread influence on the prosperity of all classes of the population. Even the higher front lands suffer, while the lower open-forest country is effectually closed to all operations of agriculture under existing conditions.

It is worthy of note that the greater part of the open forest is not covered to a depth exceeding 3 or 4 feet by any ordinary inundation. Therefore a dike and drainage system ample for the protection of agricultural lands could be established over a large portion of this territory at an expense not exceeding that incurred in similarly treated rice lands along the Atlantic and Gulf coasts. The rice crop has been intro-

duced in Louisiana at a latitude the same as that of the Yazoo area. It would thus seem possible that the inundations of the Mississippi, instead of constituting a menace and a detriment to agriculture, might be controlled and enlisted as a servant to man by the proper treatment of the open-forest country and by the introduction of the rice crop as a great staple. The climatic conditions are not adverse, the expense of diking and ditching is not extreme, the flood waters could be utilized for irrigating the fields, and after the recession of the inundation the bayous, lakes, and streams would furnish the necessary outlets for the proper drainage of the rice fields. In addition, artesian water can be had throughout the delta region by sinking wells to a depth of 750 or 1,000 feet. They could be used to irrigate considerable areas, in case the Mississippi floods should ever prove unavailable for the purpose. Moreover, the dense clays of the open swamp are adapted to the support of heavy harvesting machinery, and their fertility, if occasionally left open to inundation, could easily be maintained at the present high standard.

In general it may be said of the agriculture of the region that too great dependence is placed on a single crop—cotton; that the feed for work stock, the supplies for the laborers, and even the more finished manufactured articles, could all be produced at least within State limits without materially lessening the acreage which is annually devoted to cotton. The use of fertilizers must be more generally undertaken over the older plantations of the delta, cowpeas, cotton-seed hulls, and phosphates being best adapted to the conditions existing. The introduction of truck crops on the Yazoo sandy loam, of stock raising in the Cane Hills, and of fruit culture along the bluff, are among the immediate crop changes which would be particularly beneficial.

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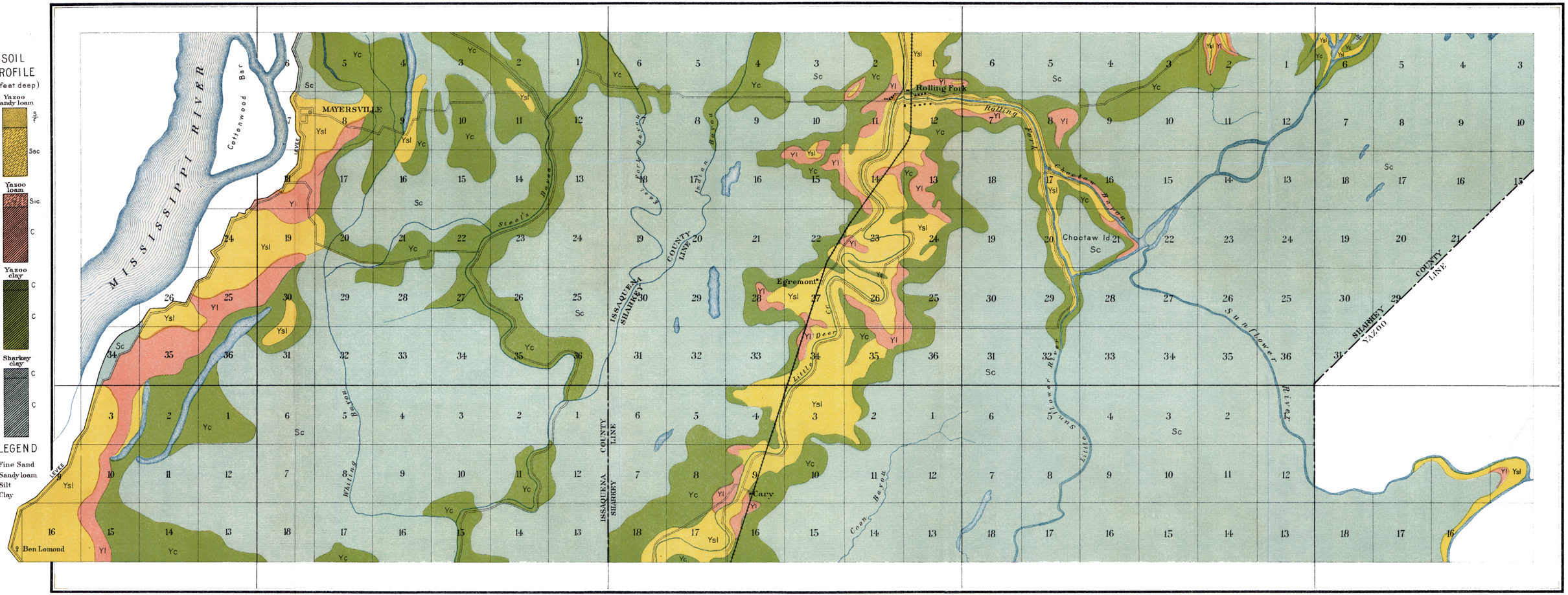
MILTON WHITNEY, CHIEF

SOIL MAP

MISSISSIPPI
MAYERSVILLE SHEET



Soils Surveyed by
Jay A. Bonsteel and party
1901

BASE MAP REDRAWN FROM
COUNTY MAP

Scale 1 inch = 1 mile

A. Hoen & Co. Lith. Baltimore, Md.

Field Operations
Bureau of Soils
1901

U.S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF

SOIL MAP

MISSISSIPPI
YAZOO SHEET

R. 5 W. | R. 4 W. | R. 3 W. | R. 2 W. | R. 1 W.

T. 12 N. | T. 11 N. | T. 10 N.

SOIL PROFILE
(3 feet deep)

Yazoo sandy loam	S F	Ssc
Yazoo loam	Sic	C
Yazoo clay	C	C
Memphis silt loam	Sic	Sic
Sharkey clay	C	C
Lintonia loam	Sic	Si
Meadow	Sic	Sc

LEGEND

Sf	Sand fine
Ssc	Sandy loam
Sc	Loam
C	Clay
Si	Silt
Sic	Silt loam

LEGEND

Ysl	Yazoo sandy loam
Yl	Yazoo loam
Yc	Yazoo clay
Yst	Memphis silt loam
Sc	Sharkey clay
Ll	Lintonia loam
M	Meadow

Inglesside, Greenhill, Florida, Wildwood, Alluvia, Grand Oak, Valley Home, Grosvenor, Sharkey County Line, Panther Creek, CAMBELLSVILLE, Lake George, Sunflower River, Pan Handle Brake, Kearney, Yazoo R.R., Lance, Brevort, Eagle Bend, Enola, Gander Clough, Choat, Oak Valley, Limerick, Woodstock, Templeton, Hopewell, Yazoo R.R., LAKE CITY, Andrews Place, Wolf Lake, Eldorado, Ferry, Home Park, Como, Mayplace, Race Track Field, Norway, Inchuka, Lintonia, Tokeba, Elm Grove, YAZOO CITY, Longwood, Wilton 1, Palo Alto, Seasing's Place, Yazoo River, Miss. Valley R.R., Poplar Grove, Duck Pond, Liverpool, Holly Bend, Sestos, Oaklands, Abydos, Benton, Boylan, Myrtle Grove, Wallaxabogue, Blacks Quarter, Paradise, DOVER, Conehilla Flat Hills, Region, Yazoo River

Soils Surveyed by
Jay A. Bonsteel, W. E. Hearn
F. W. Taylor and Frank Bennett, Jr.
1901

BASE MAP REDRAWN
FROM COUNTY MAP

Scale 1 inch = 1 mile

A. Hoen & Co. Lith. Baltimore, Md.

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